



# Radar Data Concerns

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# Radar Data Quality Workshop - Data Concerns

- General Radar Data Issues
  - TEP is at the mercy of the tactical radar to a large extent
    - Maximum range
    - Waveform selection (tactical operation - Clear vs. MTI)
    - Power Settings (High vs. Low transmit power)
    - Radiation Inhibit Sectors (i.e. radiation dropouts when in flight quarters, etc.)
    - Azimuth and Elevation Resolution dictated by SPY-1 antenna physics
      - Elevation angles dictated by SPY-1 search pattern
    - RFP Data is Limited by operation of the Radar



# Radar Data Quality Workshop - Data Concerns

- **Data Transfer Size**
  - Standard 4-moment UF file approximately 10 Mbytes
  - Additional Level III products (Comp Z, Precip. Rate, Echo Top Height, VAD, RFC) increases data size
    - possible 50 to 100 percent increase (15 to 20 Mbytes total)
  - Sending data every five minutes might overwhelm the finite bandwidth available off-ship
    - Assumed values for TEP LOW on USS Normandy - actual bandwidths were lower due to conditions and IT warfare
    - ~ 43 kBytes / sec via LOS
    - ~ 8 kBytes / sec via INMARSAT
  - **Data Classification and Transfer Issues are Vital to Success**



# Radar Data Quality Workshop - Data Concerns

- **Radial Velocity and Spectrum Width Measurements**
  - **Radial Velocity and Spectrum Width require 3-pulse MTI waveform scheduling or pulse Doppler waveform scheduling**
    - SPY-1 automatically schedules MTI unless operator overrides radar doctrine
    - Pulse Doppler waveform must be implemented and changes tactical operation of radar
  - **Solution may require forcing radar to schedule MTI dwells to provide velocity estimates to get full velocity coverage or accepting a possibly sparse velocity map due to SPY-1 MTI scheduling**

*Need to Address Waveform Selections and Implementation with NSWC-DD*



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- **Velocity Azimuth Display (VAD) using 3-Pulse MTI**
  - VAD can be executed on radial velocity measurements from 3-pulse MTI waveforms
  - There are limitations the effectiveness of 3-pulse VAD
    - Signal-to-noise ratio in clear air may limit clear air wind detection to a few kilometers
    - Areas of sufficient signal return cannot be combined with areas of insufficient signal returns (i.e. noise regions)
      - Offset VAD can solve this, but requires a 'smart' VAD algorithm to automatically select regions where sufficient signal exist and use only these regions for VAD
      - Offset VAD was done manually in TEP at-sea demo



# Radar Data Quality Workshop - Data Concerns

- **Velocity Azimuth Display (VAD) using 3-Pulse MTI**
  - Limitations the effectiveness of 3-pulse VAD (continued)
    - MTI radial velocity accurate when suitable reflectivity is present - however, internal flow in a rain storm may not reflect the flow external of the rain storm
      - Off Hawaii, 1999 - Light precip. surrounding ship - good VAD match to radiosonde winds
      - Off Jacksonville, 1999 - Strong squall over coast - less accurate VAD match to radiosonde winds
    - SPY-1 doctrine dictates use of MTI waveform (see Radial Velocity and Spectrum Width Measurements slide)

*MTI VAD Has Limited Ability*

